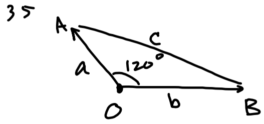
35

$\frac{da}{dt} = 14 \quad \frac{db}{dt} = 21 \quad$ Find $\frac{dc}{dt}$

when $a = 5,\ b = 3$



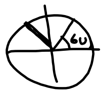
law of cosines

$\theta = 120^\circ$

$\cos\theta = -\frac{1}{2}$

$c^2 = a^2 + b^2 - 2ab\cos\theta$

$c^2 = a^2 + b^2 + ab$



$2c\frac{dc}{dt} = 2a\frac{da}{dt} + 2b\frac{db}{dt} + a\frac{db}{dt} + b\frac{da}{dt}$

$\cos 60^\circ = \frac{1}{2}$

$\cancel{2\sqrt{5^2+3^2+15}}\ \frac{dc}{dt} = \frac{2\cdot5\cdot14 + 2\cdot3\cdot21 + 5\cdot21 + 3\cdot14}{14}$

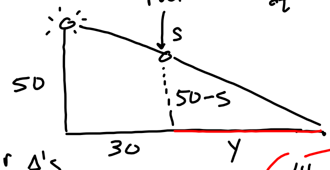
$= 29.5$

Oct 24-9:42 AM

30. light rock Find $\frac{dy}{dt}$

$s = 16t^2$ ft/sec

when $t = \frac{1}{2},\ s = 4$



$\frac{ds}{dt} = 32t \Big|_{t=\frac{1}{2}} = 16$

similar Δ's

$\frac{50-s}{y} = \frac{50}{30+y}$

$(50-s)(30+y) = 50y$ plug in $s=4$

$46(30+y) = 50y$

$46\cdot30 + 46y = 50y$

$\frac{46\cdot30}{4} = y = 345$

$(50-s)\frac{dy}{dt} + (30+y)\left(-\frac{ds}{dt}\right) = 50\frac{dy}{dt}$

$46\cdot\frac{dy}{dt} + (30+345)(-16) = 50\frac{dy}{dt}$

$(-1500) = \cancel{375(-16)} = 4\frac{dy}{dt}$

Oct 24-10:10 AM

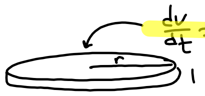
4.6b Related Rates

Pancake batter pours on a griddle at the rate of 1000 cc per minute. (cm^3)
The resulting circular pancake is 1 cm thick.
(a) Find an expression for the rate at which the radius grows. What does the expression tell you?
(b) How fast is the radius growing when it is 6 cm? $\frac{dr}{dt} = ?$

$\frac{dV}{dt} = 1000\ \frac{cm^3}{min}$

V = volume

r = radius



$V = \pi r^2 \cdot 1 = \pi r^2$

$\frac{dV}{dt} = 2\pi r \cdot \frac{dr}{dt}$

a) $\frac{dr}{dt} = \frac{1000}{2\pi r}$

as the radius gets bigger it grows slower

b) $\frac{dr}{dt} = \frac{1000}{2\pi(6)}$

$\frac{dr}{dt} = 26.526\ \frac{cm}{min}$

Oct 27-1:51 PM

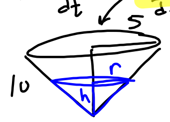
Water runs into a conical tank at the rate of 9 ft^3/min. The tank stands point down and has a height of 10 ft and a radius of 5 ft. How fast is the water level rising when the water is 6 ft deep?

Find $\frac{dh}{dt}$ $\quad \frac{dv}{dt} = 9\ \frac{ft^3}{min}$

r = radius of water

h = height of water

V = volume of water



$V = \frac{\pi}{3}r^2 h$

$\frac{r}{h} = \frac{5}{10}$

$r = \frac{h}{2}$

$V = \frac{\pi}{3}\left(\frac{h}{2}\right)^2 h = \frac{\pi}{12}h^3$

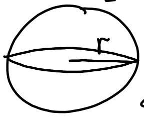
$\frac{dv}{dt} = \frac{\pi}{12}\cdot 3h^2\frac{dh}{dt}$

$9 = \frac{\pi}{12}\cdot 3\cdot 6^2\frac{dh}{dt}$

$\frac{dh}{dt} = \frac{1}{\pi}\ \frac{ft}{min}$

Oct 27-1:53 PM

The volume of a sphere grows at a constant rate of 100 cc per min.
(a) How fast is the radius growing when it is 25 cm?
(b)How fast is the surface area growing when the radius is 25 cm?



$\frac{dv}{dt}=100\ \frac{cm^3}{min}$ find $\frac{dr}{dt}$

$V=\frac{4}{3}\pi r^3$

a) $\frac{dv}{dt}=4\pi r^2\frac{dr}{dt}$

$100=4\pi\cdot 25^2\frac{dr}{dt}$

$\frac{100}{4\pi\cdot 25^2}=\frac{dr}{dt}$

b) $s=4\pi r^2$

$\frac{ds}{dt}=8\pi r\frac{dr}{dt}$

$=8\pi\cdot 25\cdot\frac{100}{4\pi\cdot 25^2}$

$=8\ \frac{cm^2}{min}$

Oct 27-2:03 PM